# *Pontia occidentalis* (Pieridae) Near Sea Level in California: a Recurrent Enigma

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**Abstract.** Two definite and one probable *Pontia occidentalis* have been taken near sea level in the Sacramento Valley of California in 27 years. This species normally breeds above 1500m at this latitude. All were taken in October, flying with the lowland sibling species *P. protodice*. The only explanation of these captures that is at all parsimonious entails long-range downslope dispersal, a seldom-documented event in montane non-migratory butterflies.

## Introduction

*Pontia occidentalis* (Reakirt), the Western White, and *P. protodice* (Boisduval and LeConte), the Checkered White, are sibling species that largely replace each other altitudinally in California. They are, however, frequently sympatric in the western Great Basin, and intermittently so on the mid-west slope of the Sierra Nevada (Shapiro 1992). *P. occidentalis* is not known to be resident anywhere in north-central California below 1000m, and its breeding range at the latitude of Sacramento is upslope from 1500m. Most collections contain misidentified individuals of both species, leading to erroneous distributional reports, but Shapiro (1977) recorded a definite *P. occidentalis* near sea level in the Sacramento Valley. This was noteworthy for at least three reasons: it was the first record of this species in the California Central Valley, the first in Sacramento County, and one of surprisingly few records of apparent long-range downslope dispersal by a montane California butterfly. Low-altitude species, in contrast, are commonly recorded high in the mountains and most common Central Valley species have been recorded in most or all of the Sierran counties. It is not clear that this strong asymmetry is purely a function of either flight season or area, though both are likely to play roles in it (Sheehan, Richerson and Shapiro, in preparation).

I have tracked the dynamics of *P. protodice* in both space and time in the vicinity of Sacramento for 27 years, and the presence/absence of both species along a permanent 10-station transect across California parallel to Interstate Highway 80. *Pontia protodice* fluctuates tremendously in abundance and distribution in the Valley and indeed in most of its range, but in most years the largest populations occur on dredge tailings along the American River in northeastern Sacramento County; the capture of *P. occidentalis* reported by Shapiro (1977) was made there. Since the early 1970s the population density of *P. protodice* there has varied through four orders of magnitude, and with several apparent local extinctions. Among many thousands of individual *Pontia* examined here and elsewhere in the Sacramento

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Valley, the 1976 *P. occidentalis* remained unique until 1995, when a second (albeit problematic) individual was taken some 100m from the site of the earlier capture! A third was then taken in nearby Yolo County in 1998. The conditions of these captures are unusual enough as to require comment.

The first collection was a dark female of the "winter" phenotype "*calyce*," taken 17.X.1976 at Rossmoor Bar, Rancho Cordova, Sacramento County (19.7 m) amidst a dense flight of *P. protodice*. Both sexes were present, mostly fresh, and presenting variable but normal early- autumn phenotypes easily distinguished from *P. occidentalis* (fig. 1).

The second specimen, a male, was taken at Rossmoor Bar 19 years later, 13.X.1995 also in the company of numerous *P. protodice*, again of normal seasonal phenotypes (fig. 2). This individual is somewhat ambiguous. It is strikingly different from the others collected the same day, varying in the direction of *P. occidentalis* in most characters. Had it been taken in the western Great Basin in an area of sympatry it would have been relegated to the roughly 1% of wild specimens I cannot assign confidently to either species, and suspect to be hybrids. These are quite variable among themselves, but most - including the 1995 Rossmoor Bar male - have been rather closely duplicated among laboratory hybrids. Similar specimens also occur in areas of sympatry in Colorado. Such ambiguous individuals are occasionally taken within apparently pure *occidentalis* populations, but this is the first and only one I have gotten in an ostensibly pure *protodice* population. I revisited the site at two-week intervals for the remainder of the season, finding nothing unusual.

The third specimen, like the 1976 one, is a heavily-marked "*calyce*," in this case a male. It was taken among normal *protodice* at Willow Slough, Yolo County (14.5 m), 10.X.1998 and is strikingly different-looking from them (fig. 3). Willow Slough is approximately 30 km due west of Rancho Cordova. The site is a weedy, overgrown floodplain; the butterflies were nectaring at *Aster*. I revisited Willow Slough three times from mid-October into early November but found no more *P. occidentalis*. This is the first record of *P. occidentalis* in Yolo County; it was not expected. *P. protodice* is often found at Willow Slough in autumn, but is not persistent. For example, it was found there in 6 of 22 Fourth of July counts since 1977, and was common only twice (1977 and 1992).

All three specimens are deposited in the Bohart Museum of Entomology, UCD.

## Discussion

These three *P. occidentalis* were captured within 7 calendar days (X.10-17), but in different years. This hints at a common process giving rise to all three records. The obvious candidate is downslope dispersal.

In all three cases the weather pattern during the preceding week was the same, with strong high pressure and a gentle NNE (i.e., downslope) wind at the surface and aloft, giving fair, warm conditions. This is a very common autumnal pattern. I have reviewed my long-term records and can find no

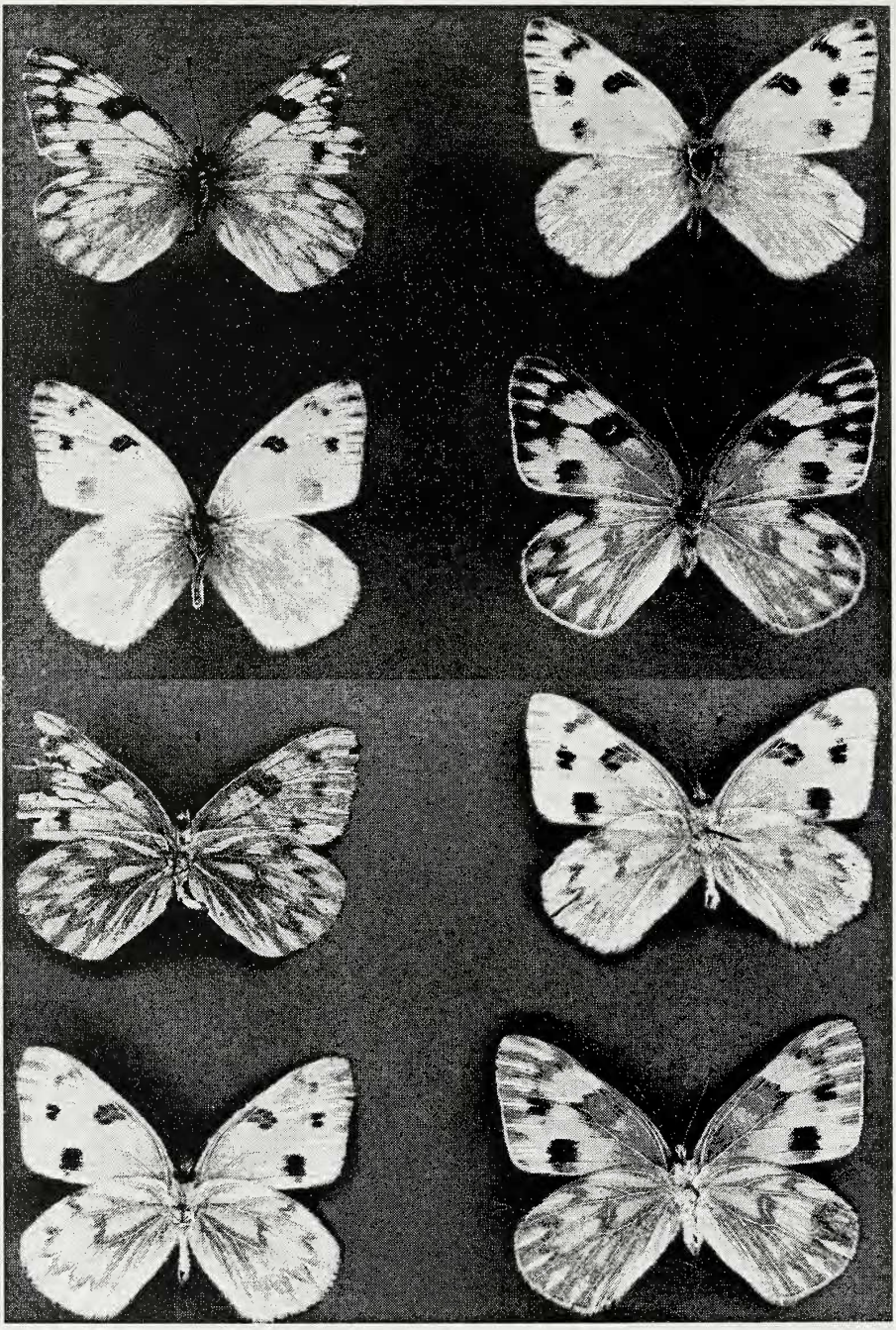

Fig. 1. Female *P. occidentalis* and several *P. protodice* collected with it, Rancho Cordova, Sacramento Co., CA, 17.X.1976, upper and lower surfaces.

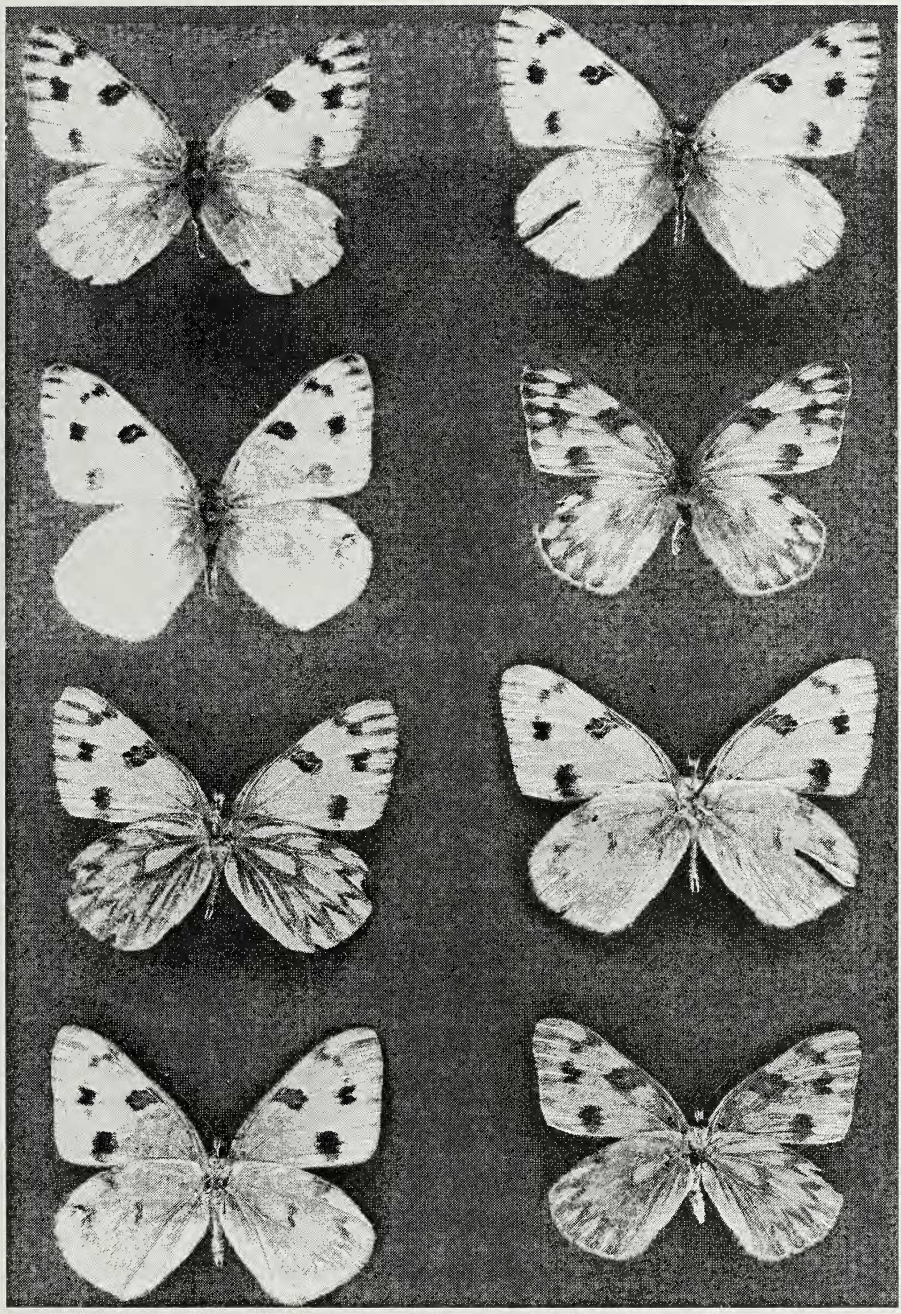

Fig. 2. Male *P. occidentalis*/hybrid (?) and *P. protodice* collected with it, Rancho Cordova, Sacramento Co., CA, 13.X.1995, upper and lower surfaces.

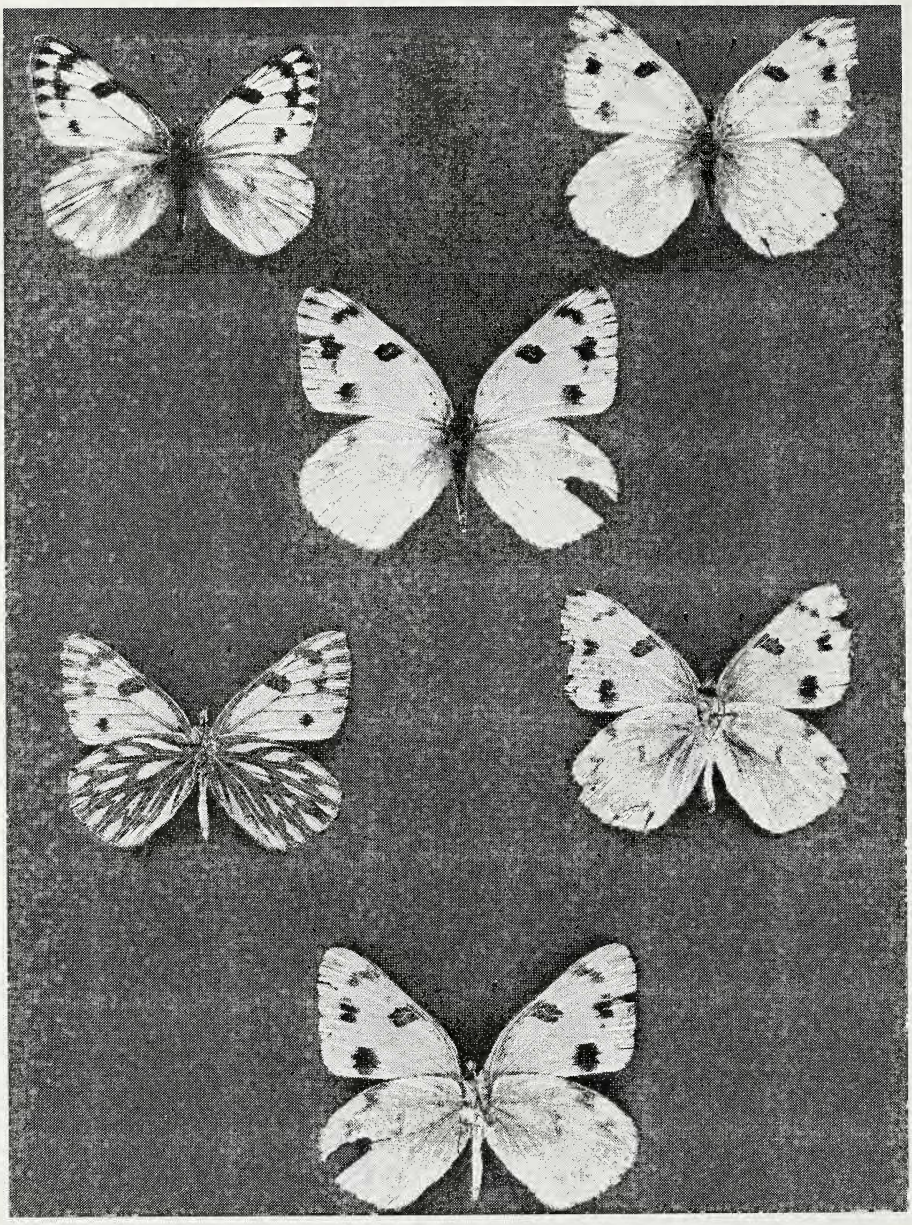

Fig. 3. Male *P. occidentalis* and *P. protodice* collected with it, Willow Slough, Yolo Co., CA, 10.X.1998, upper and lower surfaces.

pattern of downslope dispersal by other montane butterfly species under these conditions; however, such dispersal is very rarely seen at all in non-migratory montane species.

October is usually the month of maximum density and maximal areal occupation in the Valley for *P. protodice*, but it is difficult to see how this could account for the occurrence of *P. occidentalis*. Furthermore, October is not usually the month of greatest abundance for *P. occidentalis* in its normal montane range. Shapiro (1992) reviewed the dynamics of both species at 1500m on the Sierran west slope, where neither is a permanent resident. *P. occidentalis*, whose nearest permanent population (at 1900 m) is less than 15 km away, dispersed to my Lang Crossing site in 8 of 20 years, and bred in 4. This site is monitored biweekly from snowmelt through late October - early November. Of 17 dates when it was recorded there, 6 were in August and 4 each in July and September - only 1 in October. There is no evidence of a regular seasonal downslope movement, although we know *P. protodice* moves upslope from the Nevada desert in late spring (Shapiro 1992). In some years the densest populations of *P. occidentalis* at 1500m on the Sierran east slope do occur in October, where breeding occurs on Cruciferous weeds in irrigated alfalfa. The three Valley captures, however, do not coincide with known outbreaks of *P. occidentalis* on the east slope, and the dispersal distances required are on the order of 200 km, including the crossing of the Sierran crest. It is, however, noteworthy that both the 1976 and 1998 specimens correspond closely to the mean phenotypes flying at both 1500m on the east slope and 2100m on the crest (Donner Pass) at that time. The 1995 specimen is too idiosyncratic for such a comparison, but would not be "out of place" at either elevation as a putative hybrid; I have similar individuals taken in autumn at Sierra Valley, Sierra Co., an area of sympatry. See Shapiro (1976) for phenotypic exemplars.

Shapiro and Geiger (1986) demonstrated electrophoretically that under conditions of mutual abundance in sympatry, hybridization between these two species must be a rare event since no heterozygotes were found for a species-specific fixed allelic difference. It may occur more often when one species is much more abundant than the other. Hybridization appears to be more frequent in Colorado (J. Kingsolver, D. Wiernasz, personal communication).

When the species status of *P. protodice* and *P. occidentalis* was still unclear, the occurrence of *occidentalis* within what should be pure *protodice* populations could be ascribed to intrapopulational variation. This "explanation" is no longer tenable, at least for the 1976 and 1998 specimens, which are unambiguously *occidentalis* using Chang's (1963) and my own wing characters. Neither specimen would arouse any special comment if labeled as coming from 3000m in the High Sierra.

Shapiro (1977) observed that the similar habitat preferences and behaviors of the two species could account for a dispersing *P. occidentalis* lingering in a prime *protodice* habitat, such as Rossmoor Bar. That hypothesis remains tenable.

The idea that two and possibly three *P. occidentalis* would disperse in different years from the montane Sierra to the floor of the Sacramento Valley at exactly the same season - two to the exact same location! - and "join up" with resident populations of the sibling species *P. protodice*, where they were then accidentally discovered, strains credulity. Nonetheless, it is the only hypothesis that is at all parsimonious, and it suggests that there may indeed be an inconspicuous, low-density downslope movement by this species in autumn that we should be looking for.

*Acknowledgments.* I thank Michael Plotkin for acceding to my impulsive request to be dropped by the side of the road at Willow Slough on 10.X.1998, rather than at my house or lab. Without that bit of serendipity I would be much less perplexed.

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